

# **Why Simulation and Why Distributed Simulation?**

**Colonel Kenneth C. Konwin, USAF  
Director  
Defense Modeling and Simulation  
Office**



# Why Simulation?

## The Problem: Complexity

**Increased Complexity demands more practice, prototypes, and experimentation which the budget does not permit**

**Complexity  
of  
Operations and Systems**

**M&S can bridge the Gap by...**

- Expanding Training Horizons
- Supporting a New Acquisition Paradigm
- Exploring New Technologies

**Resources**

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# M&S is Critical to DoD's Ability to Meet its Mission

## Continuing squeeze on DoD resources


- shrinking, dispersed force structure
- competition for funds limits field exercises
- need to carefully examine every investment

## More demanding operational requirements

- new, more complex missions
- vastly expanding mission space
- increased complexity of systems and plans
- increasing demand for joint training
- security challenges (e.g., information warfare)

## Much more technical capability at less cost

- communications
- computers
- software technology
- displays/human-machine interfaces
- data storage and management



**Advanced  
M&S offers  
a cost-effective  
and affordable  
solution**

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# THE MACHINE THAT CHANGED THE WORLD

THE STORY OF  
LEAN PRODUCTION

HOW JAPAN'S SECRET  
WEAPON IN THE  
GLOBAL AUTO WARS  
WILL REVOLUTIONIZE  
WESTERN INDUSTRY



**JAMES P. WOMACK, DANIEL T. JONES, AND DANIEL ROOS**

**HOW  
JAPAN'S  
SECRET  
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IN THE  
GLOBAL  
AUTO WARS  
WILL  
REVOLUTIONIZE  
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INDUSTRY**



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**JAMES P. WOMACK, DANIEL T. JONES, AND DANIEL ROOS**

**No new idea springs full  
blown from a void. Rather,  
new ideas emerge from a set  
of conditions  
in which old ideas no longer  
seem to work...**

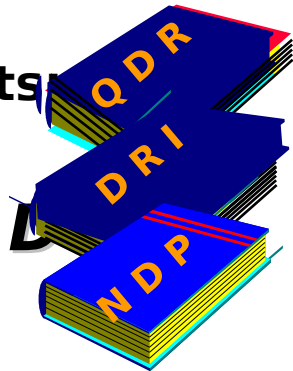
James Womack, Daniel Jones, and Daniel Roos, The Machine That Changed The World: The Story of Lean Production. New York: Harper Perennial, 1991.

# Three Revolutions Are Occurring in DoD

1997: 3 Major  
DoD

Documents

Q D R



## What we Buy - Revolution in Military

- Joint Vision 2010 warfighting concepts
- Exploit technology to achieve
- Joint Experimentation

### Common reform principle

- Focus enterprise on unifying vision
- Commit leadership team to change
- Focus on core competencies
- Streamline organizations for agility
- Invest in people
- Breakdown barriers between organizations
- Exploit info technology

**QDR** Quadrennial Defense Review

March 31, 1998  
Defense Reform Initiative  
National Defense Panel



## How we Buy - Revolution in Business Affairs

Take advantage of Business process improvements pioneered in private sector

- A must, to maintain competitive edge in a changing global security



# Why Distributed Simulation?

**“  
...it is getting tougher and tougher all the  
time  
to train properly ... So we are pursuing  
Distributed Mission Training.”**

**General Richard Hawley, USAF  
Commander, Air Combat  
Command**

**I/ITSEC, December 4, 1997**

# We fight as an Air and Space Team, but we seldom train together as a

Air Force Distributed Mission Training

..1996

.....1999

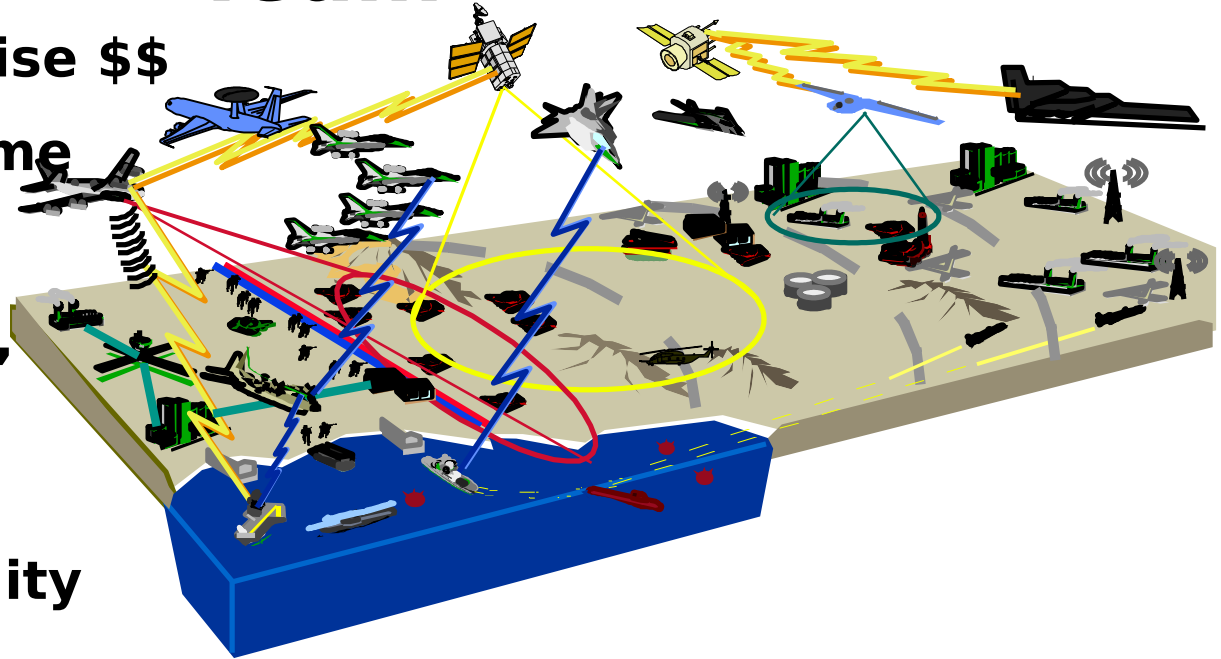
.....2003

.....2007

.....2010

## Team

- Insufficient exercise \$\$
- Reduced flying time
- Security issues
- High PERSTEMPO, OPSTEMPO
- Safety
- Airspace availability
- Environmental concerns
- Restricted weapons/EW envelopes
- Complex rules of engagement





# Distributed Mission Training

## *Supports Combat Training in a Joint Synthetic Battlespace*

Air Force Distributed Mission Training

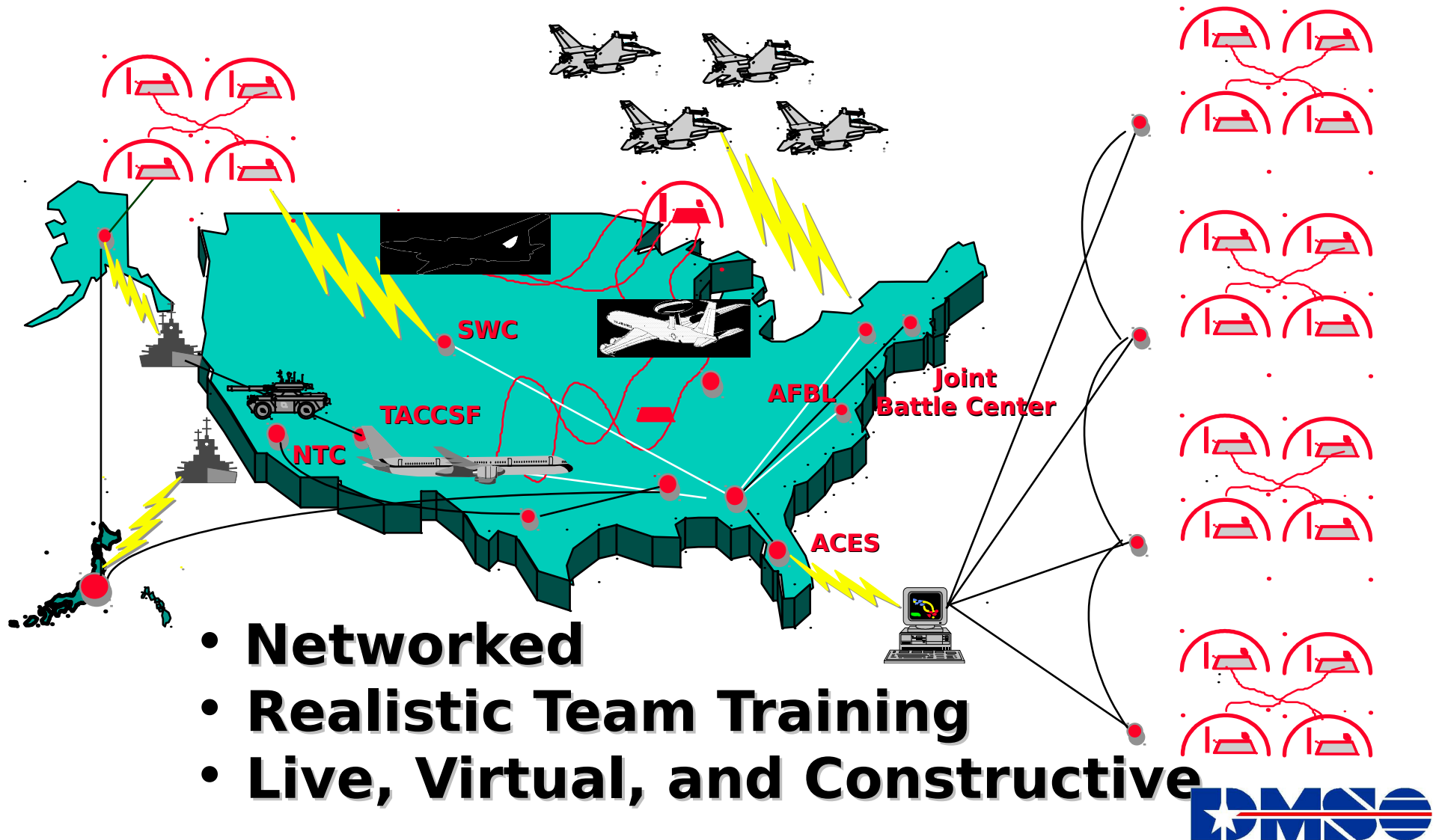
..1996

.....1999

.....2003

.....2007

.....2010



# **Why Distributed Simulation?**

**“The face of test and evaluation is changing, along with the acquisition process. The future is now, and distributed simulation is a big part of that future.”**

**Dr. Marion Williams  
Chief Scientist  
Air Force Operational Test and Evaluation  
Center**

# **Dr. Jacques S. Gansler**

## **Under Secretary of Defense for Acquisition and Technology**

**“Techniques like simulation and modeling can help us ... by reducing the risk associated with new products and processes, by saving time in the development and production phase of new systems, and by making efficient use of scarce and increasingly expensive resources.”**

**Precision Strike Association Annual Programs Review  
May 19, 1998, Ft Belvoir**

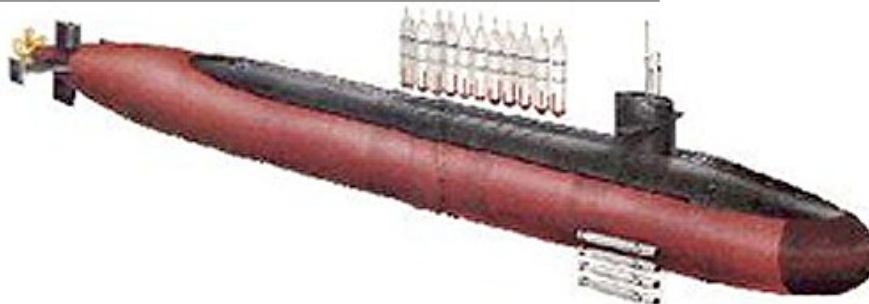
# Simulation Based Acquisition

...integrated across acquisition phases and programs...

**Total Ownership Lifecycle Support Up Front In Design**

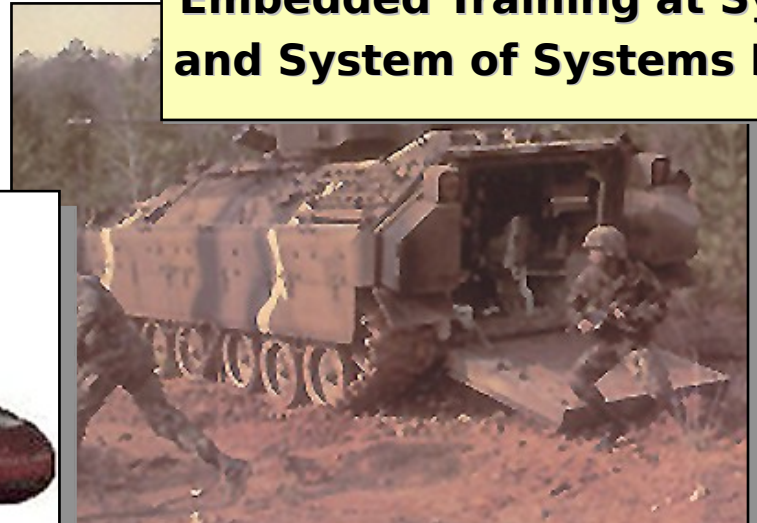


**Seamless Transition from Design to Manufacturing**



**Comprehensive Exploration of Trade Space to Select Best Value Design**

**Embedded Training at System and System of Systems Levels**



**Total Product Life Cycle Ownership**



# AVIATION WEEK & SPACE TECHNOLOGY

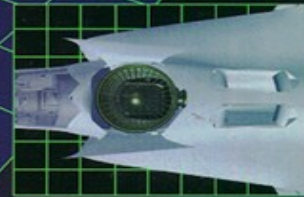
A PUBLICATION OF THE MCGRAW-HILL COMPANIES • \$5.00 • OCTOBER 6, 1997

## Computers in Aerospace Seeking the Next Edge

Page 46

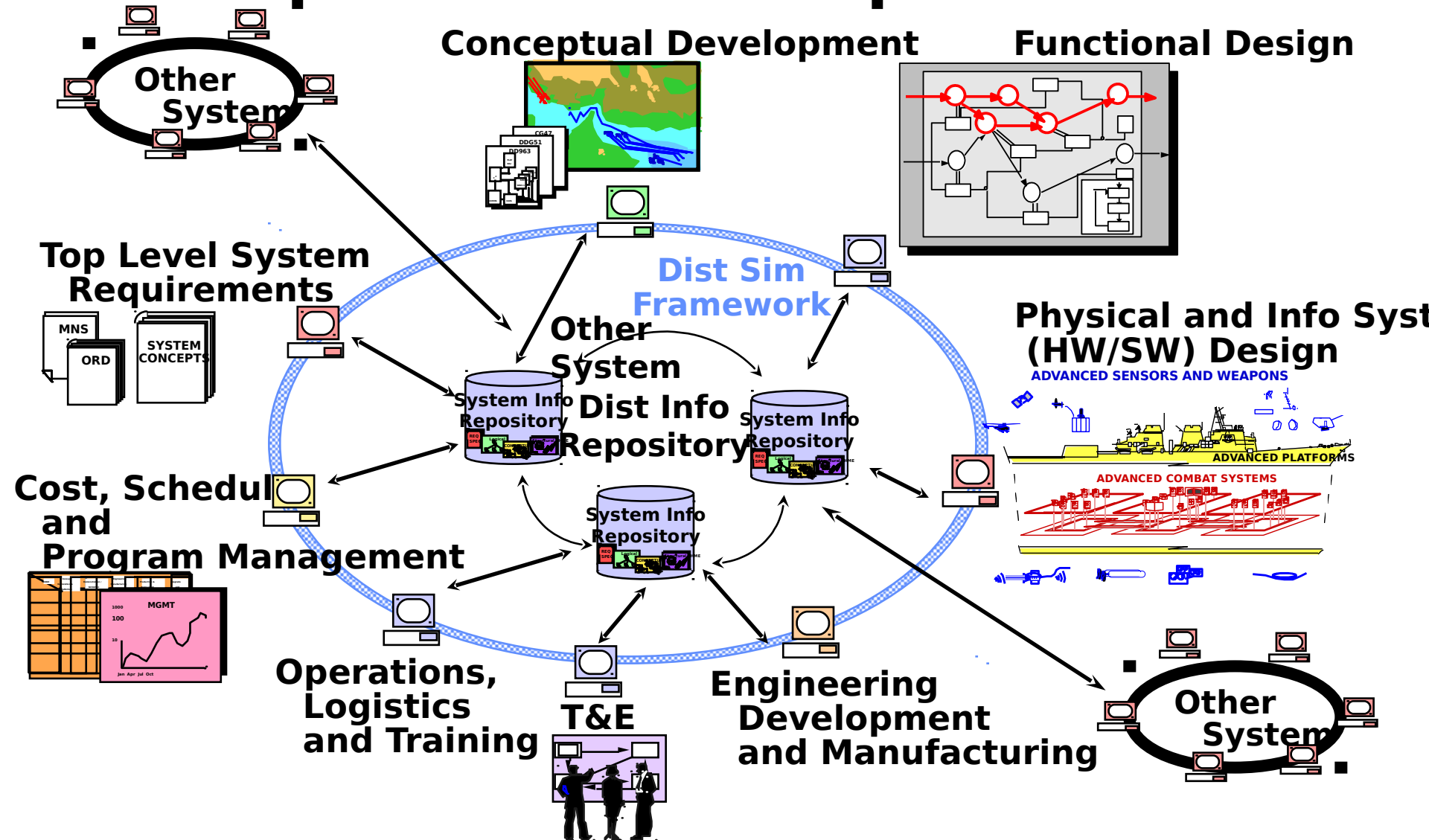


**New Warnings  
on Loose Nukes**





# SBA Operations Concept Illustration



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**Extensive Re-use Within Phases and Across Acquisition Pro**

# Joint Experimentation \*

**"U.S. Atlantic Command's new role will focus our efforts to implement our future warfare vision ... The Services have individually made great strides in modeling and simulation, and other new techniques. Our challenge now is to integrate those efforts to achieve the greatest possible capabilities in the 21st century."**

**General Henry H. Shelton, US  
Chairman of the**

**Army  
Joint Chiefs of Staff**

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\* Extract from USACOM Joint Warfighting Experimentation Charter, Enclosure to Secretary of Defense memorandum designating US Atlantic Command (USACOM)



# DoD M&S Vision

*DoD Executive Council for Modeling and Simulation (EXCIMS), March 13, 1992*

**Defense modeling and simulation will provide readily-available, operationally-valid environments for use by DoD components**

- to train jointly, develop doctrine and tactics, formulate operational plans, and assess war fighting situations
- as well as to support technology assessment, system upgrade, prototype and full scale development, and force structuring.

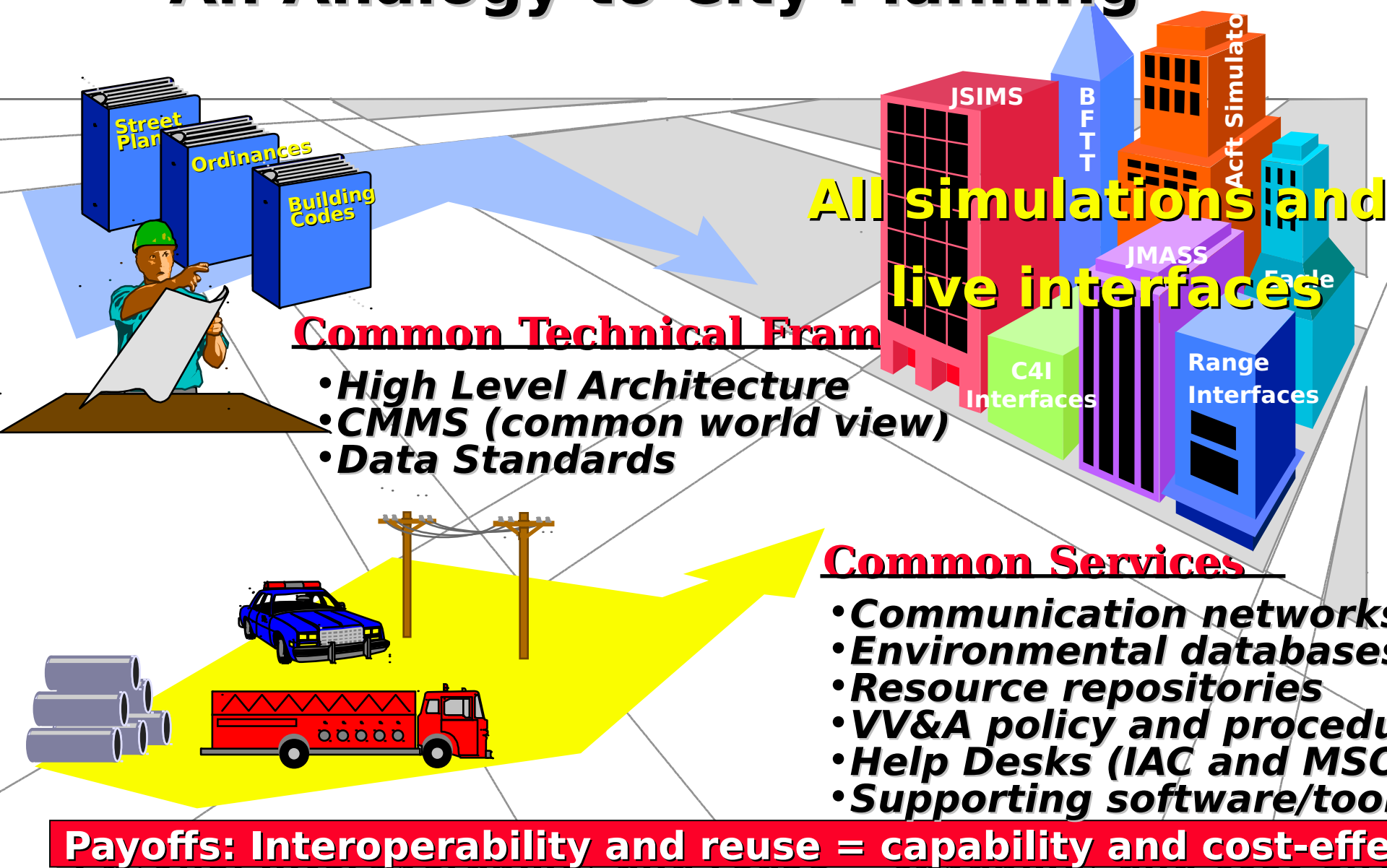
Furthermore, **common use of these environments** will promote a closer interaction between the operations and acquisition communities in carrying out their respective responsibilities. **To allow maximum utility and flexibility,**

**th co Requires a “systems of systems” approach**  
**interoperating through an open systems architecture.**

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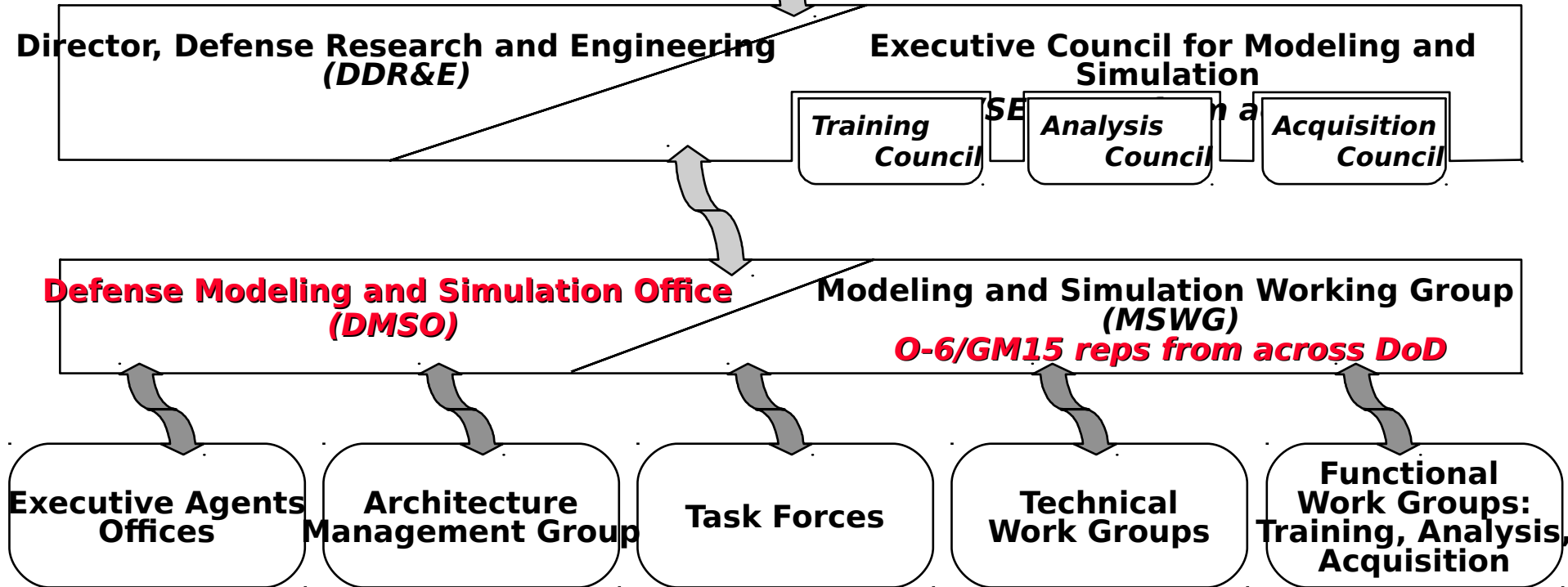


# US DoD M&S Strategy: An Analogy to City Planning



# DoD M&S Management Structure

**Under Secretary of Defense (Acquisition and Technology)**



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**Gary Yerace**  
**Chief of Staff**



**Col Crash Konwin**  
**Director**



**COL Forrest Crain**  
**Deputy Director**



**Dr. Judith Dahmann**  
**Chief Scientist**



**CAPT (Sel) Dave Johnson**  
**Chief, Operations**



**LtCol Mac McKeon**  
**Chief, Tech. Applications**



**Waverly Debraux**  
**Chief, Bus. & Fin. Mgmt.**

# **DMSO's Mission: Key corporate-level functions necessary to achieve the DoD Vision for M&S**

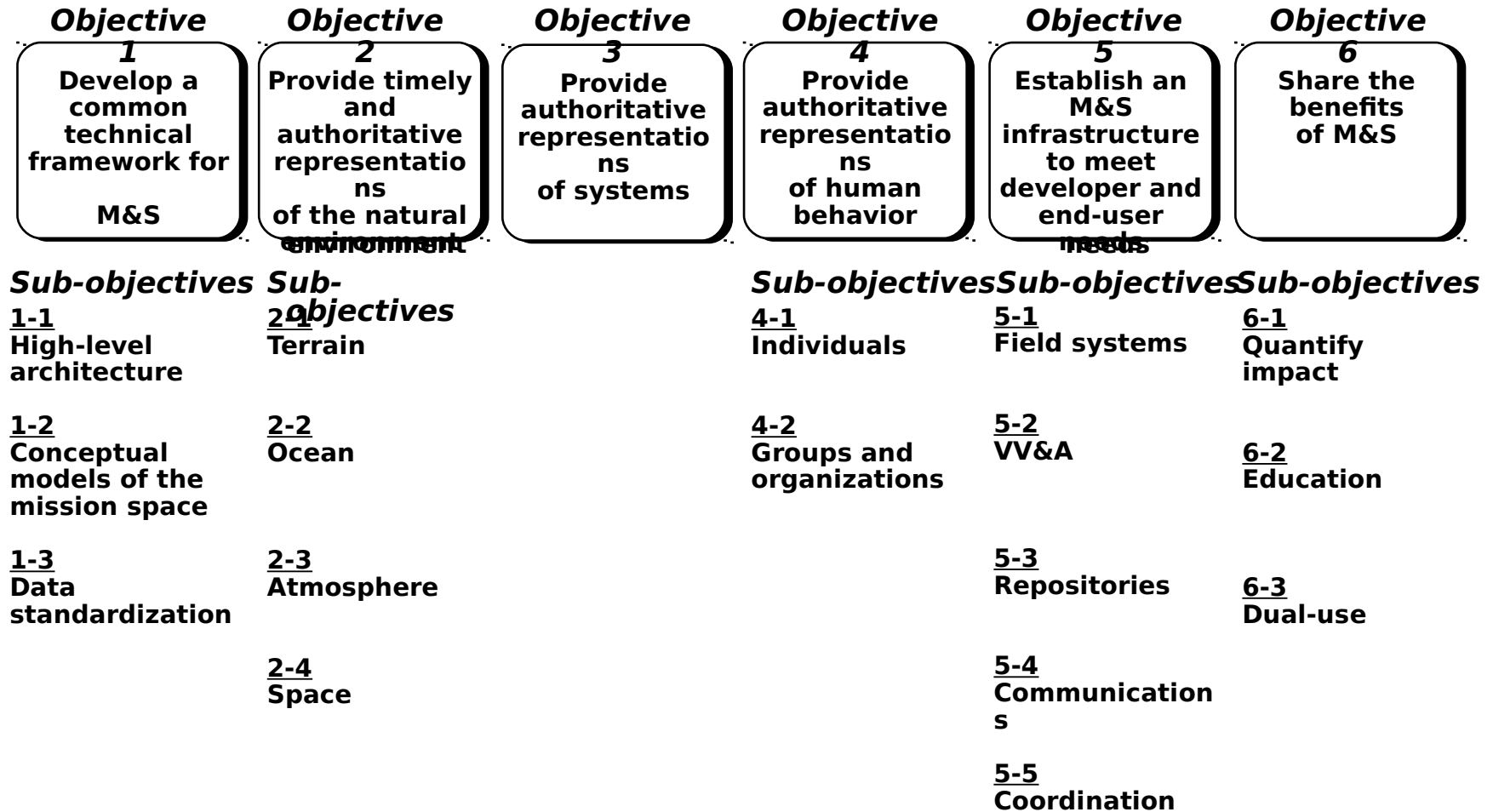
## **M&S responsibilities include**

- **Manage DoD-M&S policies, directives and publications**
- **Lead establishment and maintenance of a common technical framework**
- **Provide, or coordinate provision of, broadly-useful common infrastructure, services, and tools to the M&S community**
- **Lead development of DoD plan for the development and exploration of M&S-related technology and execute such activities as appropriate**
- **Advise, and provide OSD oversight of, major simulation programs**
- **Foster cooperative M&S developments among DoD Components**

**Represent DoD in commercial and international M&S-related organizations and standards bodies**



# The Strategy Is Being Executed Through a DoD-wide M&S Master Plan



**DoD 5000.59-P, Modeling and Simulation Master Plan, October 1999**

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**JAMES P. WOMACK, DANIEL T. JONES, AND DANIEL ROOS**

**...The key to mass production wasn't... the moving, or continuous, assembly. Rather, it was the COMPLETE and consistent INTERCHANGEABILITY of parts and the simplicity of attaching them to each other...**

James Womack, Daniel Jones, and Daniel Roos, The Machine That Changed The World: The Story of Lean Production. New York: Harper Perennial, 1991.

# M&S Master Plan

## Objective 1-1

- Establish **a common high-level simulation architecture** to facilitate the interoperability of all types of models and simulations among themselves and with C4I systems, as well as to facilitate the reuse of M&S components
- Simulations developed for particular DoD Components or Functional Areas must conform to the High Level Architecture
  - Further definition and detailed implementation of specific simulation system architectures remain the responsibility of the developing Component



# Scope of HLA

- **Applicable to broad range of functional areas (e.g., training, contingency planning, analysis, and acquisition support)**
- **Applicable to simulations involving pure software representations, man-in-the-loop simulators, and interfaces to live components (e.g., instrumented weapon systems and C3 systems)**

***The HLA provides a common architecture across a very wide set of simulation applications -- allowing for the reuse of tools, both government and commercial, across a broader range of users.***

# Representational Resources Thrusts

## 1. Models and Data

**Authoritative Sources**

**Correlation/Consistency between Algorithms and Data**

## 2. Information Exchange

**Common Semantics and Syntax (CSS)**

**Data Interchange Formats (DIF)**

## 3. Resource Production

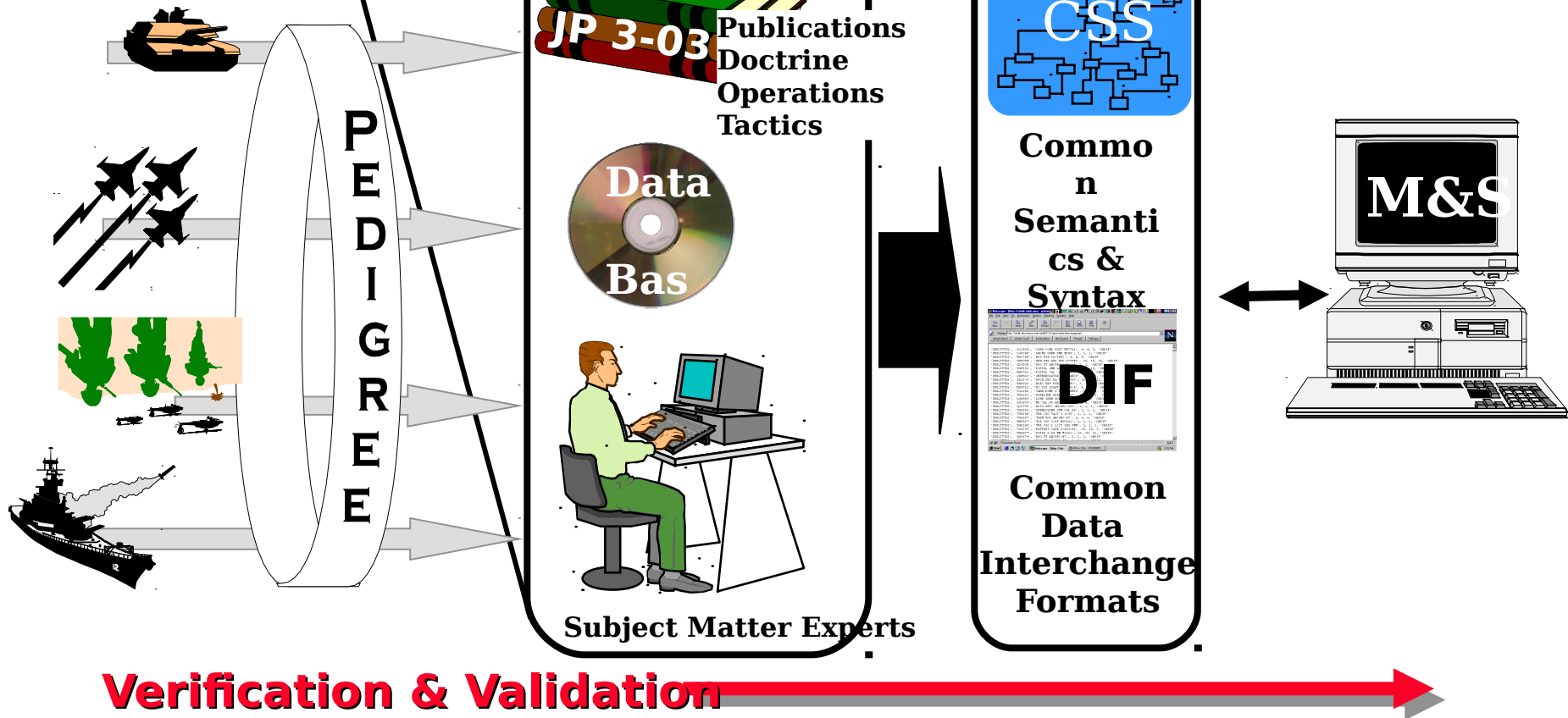
**Just-In-Time Environmental Data**

**Data Quality Assurance Guidelines**

# Representational Resources Strategy

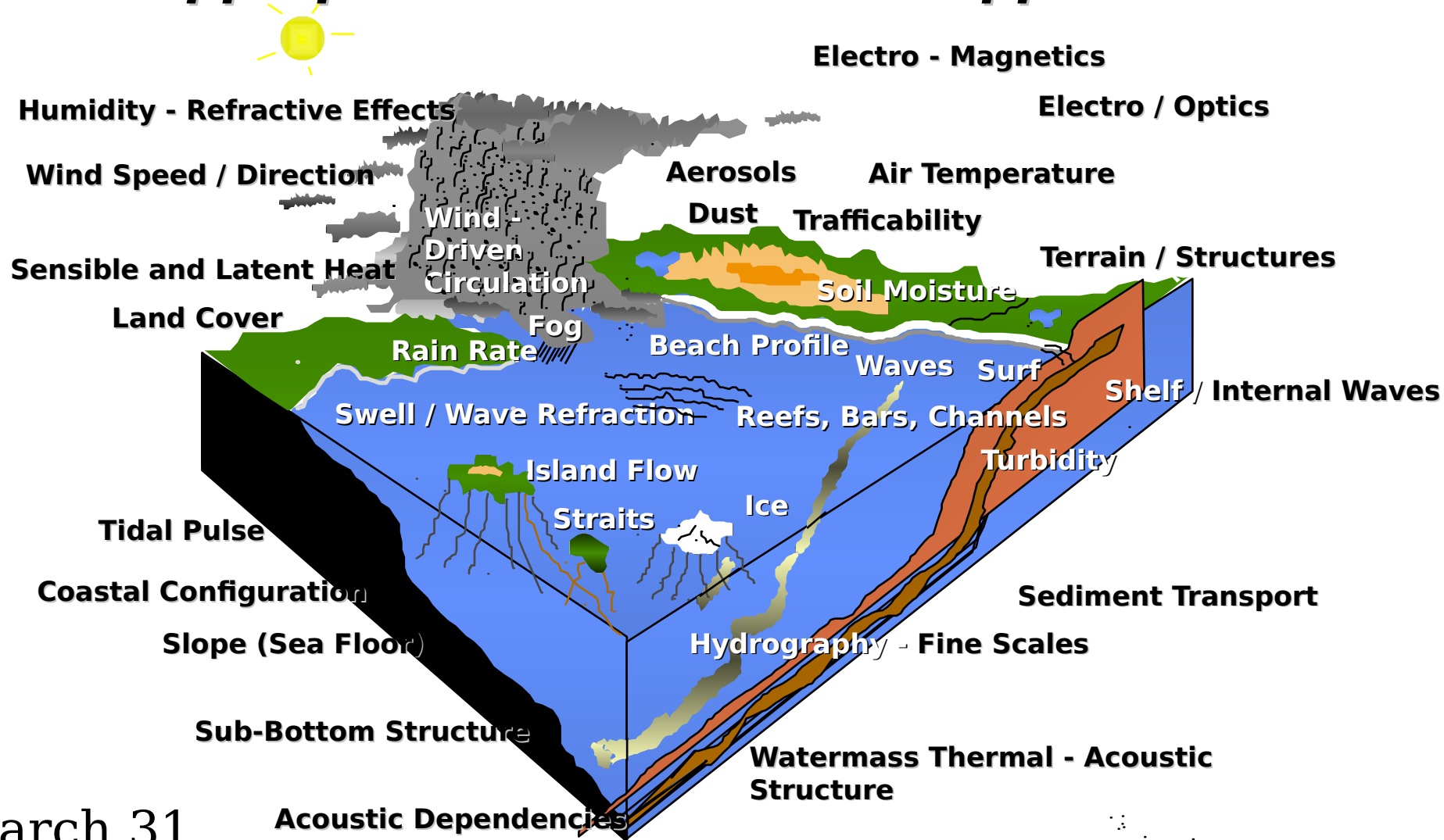
## MSRR Libraries

### Knowledge Collection



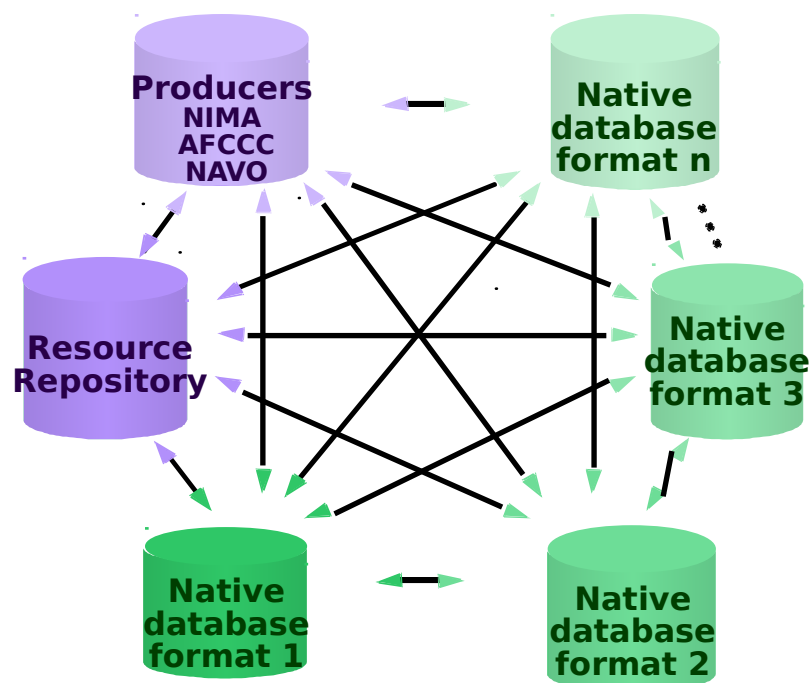
# Environmental Representations - The Vision

*An appropriate environment ... applied consistently*

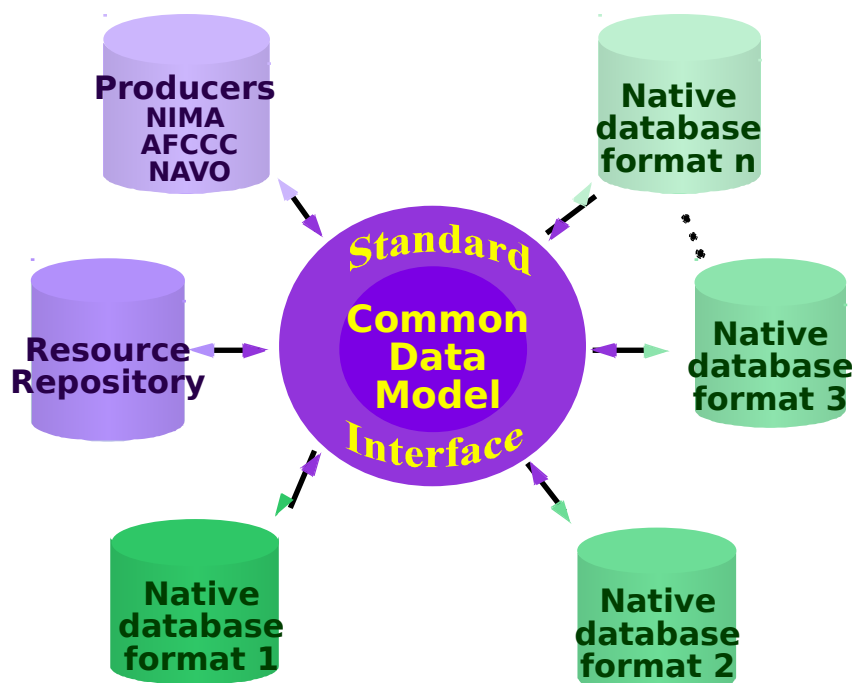


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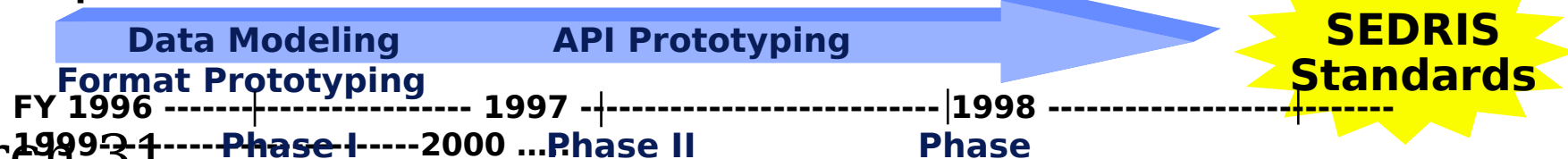
# Synthetic Environment Data Representation & Interchange Specification (SEDRIS)



- No standard data model
- Limited support to heterogeneous simulation
- Indeterminant interchange mechanism
- Expensive database conversion



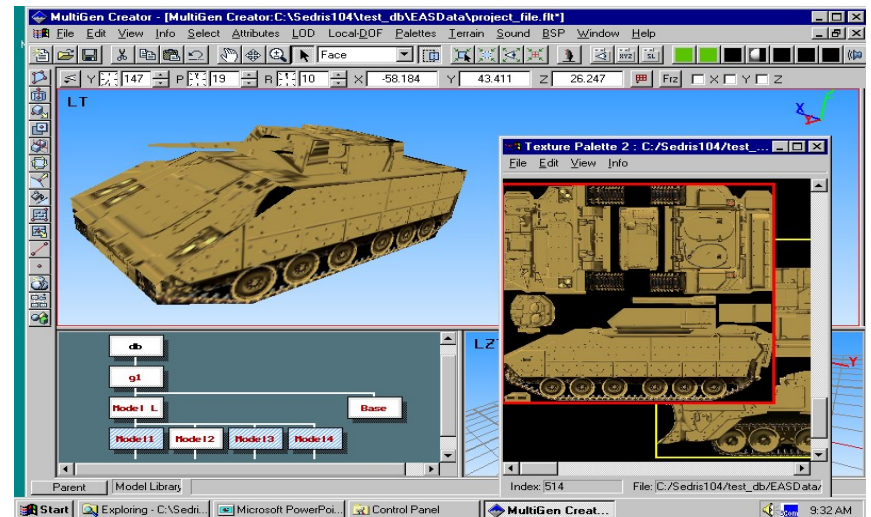
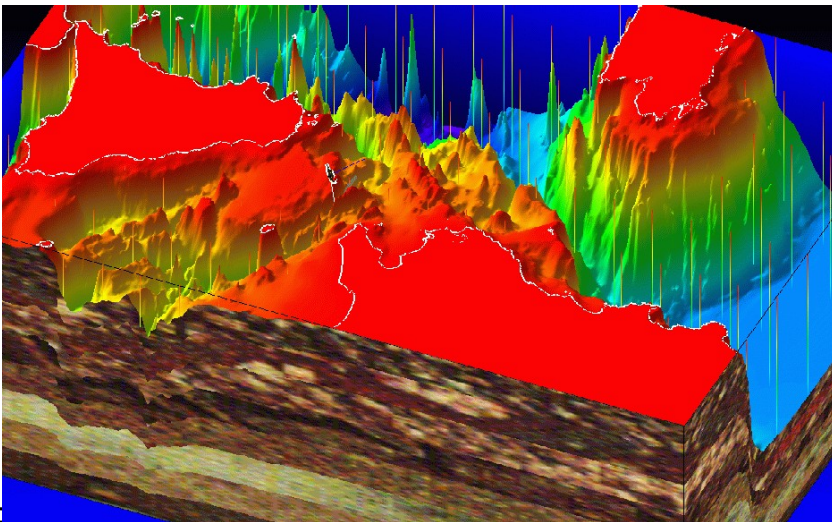
- Complete representation
- Enables interoperability
- Lossless and consistent interchange
- Reduction in conversion cost



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# A Full Range of Applications ...



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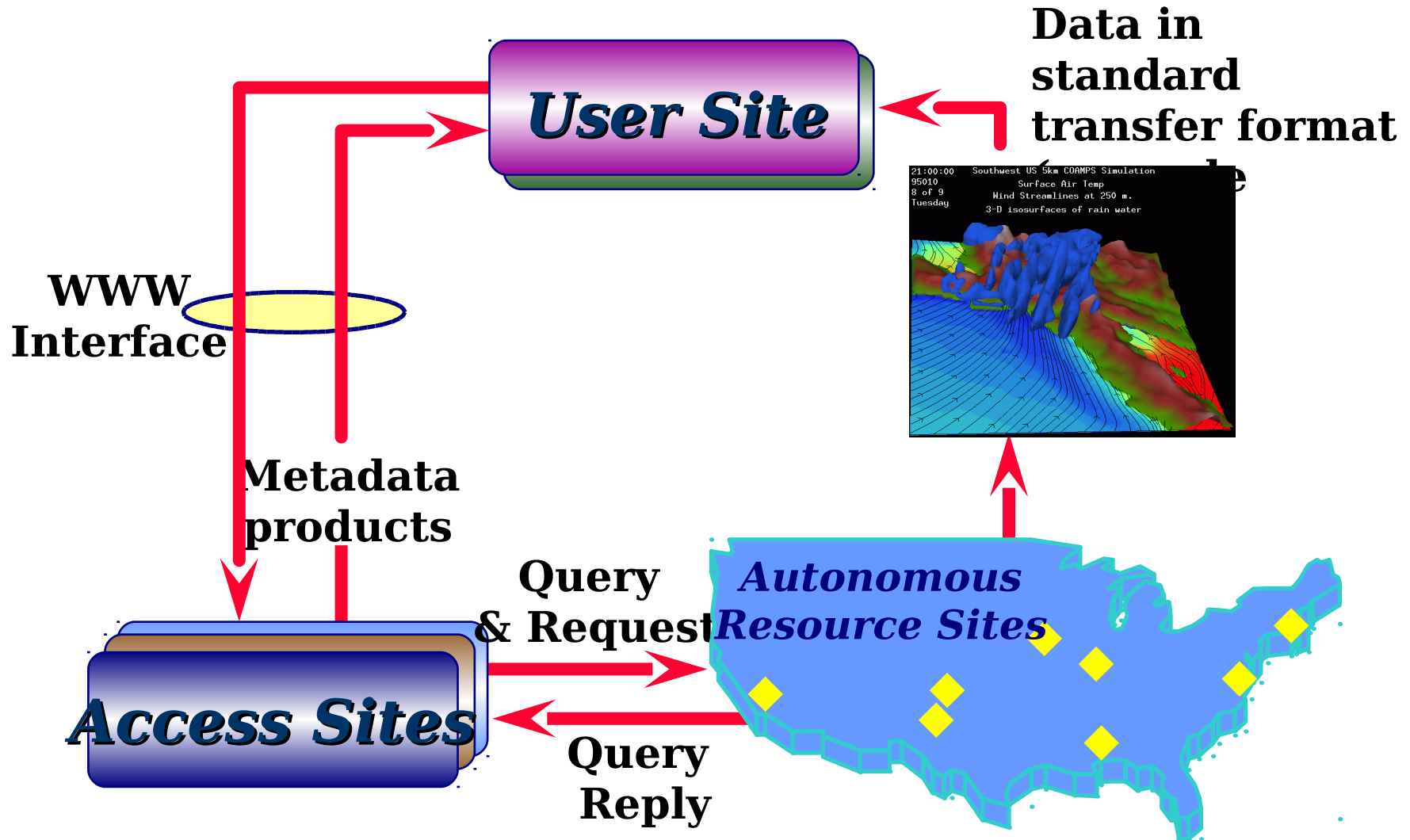


**JAMES P. WOMACK, DANIEL T. JONES, AND DANIEL ROOS**

**Revolutions in manufacture  
are useful only if they are  
available to everyone.**

James Womack, Daniel Jones, and Daniel Roos, The Machine That Changed The World: The Story of Lean Production. New York: Harper Perennial, 1991.

# Master Environmental Library (MEL)



**Three-Tier Architecture for Simple User Access**

# Commercial and International Activities

- **Much HLA interest in commercial arena**
  - commercial products are emerging
  - interests beyond defense
- **The Simulation Interoperability Standards Organization (SISO) was formed to serve the full breadth of the M&S community, beyond DoD**
  - will develop HLA as an IEEE standard
  - Simulation Interoperability Workshops each spring and fall
- **Foreign nations have begun to build HLA-based simulations**
  - 315 RTI foreign transfer requests as of 31 Jul 98
- **The NATO Military Committee and Conference of National Armament Directors (CNAD) have chartered a Steering Group on M&S**
  - completed first-ever NATO M&S Master Plan, including interoperability and reuse standards
  - HLA/Common Technical Framework accepted as a baseline
  - HLA workshop July 1997 in The Hague



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**... there are four basic differences in design methods employed by mass and lean producers. These are differences in leadership, teamwork, communication, and simultaneous development.**

James Womack, Daniel Jones, and Daniel Roos, The Machine That Changed The World: The Story of Lean Production. New York: Harper Perennial, 1991.

# Conclusion

**PEOPLE** are the most important ingredient to effective change

- They deliver the technology and transition it to better tools
- They train their colleagues in effective use
- They deliver the solutions to the warfighter's needs

**PARTNERSHIPS** are the only practical way ahead

- Strategic relationships tailored to application domain will increase

**PRAGMATISM** is necessary to discover the affordable way ahead

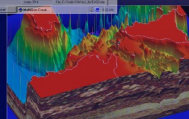
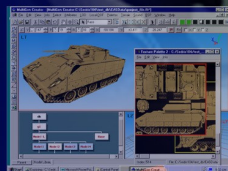
- Must satisfy today's needs better while preparing for an even better tomorrow



# U.S. Defense Modeling and Simulation Office

*Vision and Direction . . .*

*Providing the Means for Interoperability  
and Re-use for the Warfighter . . .*



**DoD M&S Vision**

1. In 1991, the Deputy Secretary of Defense assigned overall management responsibility of all DoD M&S to the USD(A), now the USD for Acquisition and Technology. To assist the USD(A) in managing DoD M&S, the USD(A) established the DoD EXCIMS and granted it oversight and management authority. The USD(A) tasked the EXCIMS to develop a vision for DoD M&S to help focus the DoD's M&S community on core functions. The EXCIMS focused on applying M&S in ways that would enhance overall U.S. military capability.
2. These ideas were incorporated by the EXCIMS into the DoD M&S vision:
  - a. Defense modeling and simulation will provide readily available, operationally valid environments for use by the DoD Components.
    1. To train jointly, develop doctrine and tactics, formulate operational plans, and assess wargaming situations.
    2. To support technology assessment, system upgrade, prototype and full-scale development, and force structuring.
  - b. Furthermore, common use of these environments will promote a closer interaction between the operations and acquisition communities in carrying out their respective responsibilities. To allow maximum utility and flexibility, these modeling and simulation environments will be constructed from affordable, reusable components interoperating through an open systems architecture.